

We claim:

1. A synthesizer comprising:

a phase lock loop circuit;

a microcontroller, coupled to and configured for optimizing a bandwidth characteristic of said phase lock loop over a range of variable output frequencies;

said microcontroller further configured for carrying out a self-calibration procedure for said phase lock loop; and

said self-calibration procedure involving a monitoring of a tune voltage for a voltage-controlled oscillator and manipulation of inputs into said phase lock loop circuit.

2. A synthesizer of claim 1 wherein said inputs include a variable loop division ratio.

3. A synthesizer of claim 2 further comprising:

an integrator within said phase lock loop circuit;

wherein said microcontroller computes an integrator gain for said integrator and a tune sensitivity characteristic for said voltage controlled oscillator.

4. A synthesizer of claim 3 wherein said integrator further comprises an integrator op-amp, an integrator resistor and an integrator capacitor.

5. A synthesizer of claim 4 further comprising a multiplexer for providing variable resistance paths into a first input of said op-amp, where said multiplexer is controlled by said microcontroller.

6. A synthesizer of claim 5 further comprising a digital potentiometer which provides a signal to a second input to said op-amp.

7. A synthesizer of claim 6 where said microcontroller further comprises an analog-to-digital converter for converting said analog tune voltage to a digital value.

8. A synthesizer of claim 7 further comprising a modulation source configured to provide a signal to said digital potentiometer.
9. A synthesizer of claim 8 wherein said microcontroller is a field programmable gate array.
10. A synthesizer of claim 9 further comprising a phase detector having a gain of K_p , a loop division ratio of N , an integrator gain of M , a tune sensitivity characteristic of K_v , such that the bandwidth (BW) of the phase lock loop circuit is defined by $BW = M \times K_p \times K_v / N$.
11. A synthesizer of claim 5 wherein a phase detector gain is controlled by the microcontroller.

12. A synthesizer comprising:

a phase lock loop circuit;

means for optimizing a bandwidth characteristic of said phase lock loop circuit over a range of variable output frequencies, and for carrying out a self-calibration procedure for said phase lock loop;

where said self-calibration procedure involves a monitoring of a tune voltage for a voltage-controlled oscillator and manipulation of inputs into said phase lock loop circuit.

13. A synthesizer of claim 12 further comprising:

an integrator within said phase lock loop circuit;

wherein said means for optimizing further computes an integrator gain for said integrator and a tune sensitivity characteristic for said voltage controlled oscillator.

14. A synthesizer of claim 13 wherein said integrator further comprises an integrator op-amp, an integrator resistor and an integrator capacitor.

15. A synthesizer of claim 14 further comprising means for providing variable resistance paths into a first input of said op-amp;

where said variable resistance paths are controlled by said means for optimizing.

16. A synthesizer of claim 15 further comprising a digital potentiometer which provides a signal to a second input to said op-amp.

17. A synthesizer of claim 16 where said means for optimizing further is for converting said analog tune voltage to a digital value.

18. A synthesizer of claim 17 further comprising means for providing a modulated signal to said digital potentiometer.

19. A synthesizer of claim 15 further comprising a phase detector having a gain of K_p , a loop division ratio of N , an integrator gain of M , a tune sensitivity characteristic of K_v , such that the bandwidth (BW) of the phase lock loop circuit is defined by $BW = M \times K_p \times K_v/N$; and,

a phase detector gain is controlled by said means for optimizing.

20. A method of calibrating a synthesizer with a phase lock loop circuit comprising the steps of:

providing a variable resistance path to an input of an integrator where said variable resistance is provided by a microcontroller manipulated multiplexer;

providing a tune voltage output signal from said integrator which is input into a voltage controlled oscillator;

monitoring said tune voltage output signal by a microcontroller; and

calibrating said phase lock by manipulating a loop division ratio and said variable resistance path and calculating a gain of said integrator and a tune sensitivity characteristic of said voltage-controlled oscillator across an operating range of said voltage-controlled oscillator.